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Psycho-oncological distress in patients with peritoneal surface malignancies treated with cytoreductive surgery and hyperthermic intraperitoneal chemotherapy

Andreas Brandl [ID] · Shadi Katou · Antonia Pallauf · Johann Pratschke · Beate Rau · Ute Goerling

Summary

Background Patients with peritoneal metastases suffer from physical and psychological distress. The aim of our investigation was to identify highly distressed patients, collect demographic data, and examine correlations between distress score and clinical outcome.
Methods This retrospective analysis included all patients who were treated for peritoneal surface malignancies with cytoreductive surgery and hyperthermic intraperitoneal chemotherapy in our department. Psycho-oncological screening was conducted preoperatively.
Results From a total of 213 patients, 105 (49.3%) participated in the psycho-oncological screening. Women had a higher score (6.2 ± 2.6) compared to men (4.8 ± 3.4; $p = 0.02$). Age ($p = 0.15$) and Peritoneal Cancer Index ($p = 0.90$) had no significant influence on the score. The postoperative rate for surgical (19/73) or non-surgical complications (20/73) in highly distressed patients was comparable to patients with low distress (9/31, 11/31; $p = 0.46$, $p = 0.28$). Psychological problems due to sadness (Odds Ratio [OR] 2.69; $p = 0.009$), sleeplessness (OR 3.01; $p = 0.004$), and the physical ability to get around (OR 2.65; $p = 0.01$) were identified as having the greatest impact on distress scores.

Conclusion The mean distress score in patients with peritoneal surface malignancies is high (5.4 ± 2.7), is not related to the medical prognosis of the patients due to their underlying disease, and showed no correlation to the complication rate. Sadness and problems with sleep and getting around have a major influence on this score.

Main novel aspects

(I) This is the first study ever focusing on psychooncologic distress in patients with peritoneal surface malignancies.

(II) The mean distress score in patients with peritoneal surface malignancies is high.

(III) The high distress score is not related to the medical prognosis of the patients due to their underlying disease and showed no correlation with the complication rate

Introduction

Patients with peritoneal metastases from gastrointestinal tumors are considered as patients with advanced oncological disease (UICC IV) and are often treated with palliative chemotherapy with a poor prognosis.

If complete tumor resection is possible, patients are offered cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC). This intense multidisciplinary oncological regime is often combined with pre- and postoperative chemotherapy [1]. The positive influence of CRS and HIPEC on pa-

The authors A. Brandl and S. Katou contributed equally to the manuscript.

A. Brandl, M.D. (✉) · S. Katou, M.D. · J. Pratschke, M.D. Ph.D. · B. Rau, M.D., Ph.D.
Department of Surgery, Charité – Universitätsmedizin, Campus Virchow-Klinikum and Charité Campus Mitte, Augustenburger Platz 1, 13353 Berlin, Germany
Andreas.Brandl8@gmail.com

A. Pallauf · U. Goerling, Ph.D.
Charité Comprehensive Cancer Center, Charité – Universitätsmedizin Berlin, Berlin, Germany

tient overall survival was shown for selected patients suffering from colorectal and appendiceal malignancies or peritoneal mesothelioma [2]. These patients are evaluated with diagnostic laparoscopy to determine the extent of the peritoneal metastases while collecting the peritoneal cancer index (PCI) and in order to decide if complete cytoreduction seems achievable. The completeness of cytoreduction (CC score) in patients with colorectal cancer (CRC) or the extent of peritoneal seeding in patients with low-grade appendiceal neoplasms (LAMN) or CRC are of utmost significance for long-term survival [3–5]. The randomized trial by Verwaal et al. showed an improvement in the median survival of patients with CRC treated with CRS and HIPEC and systemic chemotherapy compared to patients treated with systemic chemotherapy alone (22.3 vs. 12.6 months) [6]. Despite the benefits for selected patients, CRS and HIPEC are associated with a considerable rate of morbidity (40–50%) and mortality (0.7–6.5%) [7–9].

Thus, it is evident that patients undergoing such a therapy regime suffer not only physical but additionally psychological distress and challenges. Analyzing the prevalence of distress in cancer patients in an acute care hospital, Singer et al. found that one third of all patients suffer from mental health disorders [10]. It was also found that higher stress before surgery is associated with increased pain, which in turn means that patients need more morphine [11]. Psychological distress can significantly influence the frequency and severity of side effects as well as adjustment and compliance [12, 13].

To which extent a negative psychological status affects the course of the disease and influences patient outcome is still unclear [14, 15]. Therefore, screening tools for detection of psychological stress and related problems in cancer patients have been integrated into clinical routine [16]. The most commonly used National Comprehensive Cancer Network (NCCN) recommended Distress Thermometer (DT) with the associated problem list (PL) has proven an efficient validation tool for cancer patients in multiple settings since its introduction in 1998 by Roth et al. [17]. With a short one-page questionnaire, patients' needs and concerns that otherwise would be overlooked are taken into consideration and eventually processed [18, 19].

However, to date, to our knowledge, no study has discussed screening for psycho-oncological distress in cancer patients undergoing CRS and HIPEC. The goals of this investigation are (I) to measure distress and related problems in patients before CRS and HIPEC, (II) to identify common psycho-oncological problems, and (III) to investigate a hypothetical correlation between screening results and patient outcome.

Materials and methods

Participants

In this retrospective pilot study, we investigated data collected from 213 consecutive patients who were treated with CRS and HIPEC between January 2013 and September 2016 at our department. The research project was approved by the local ethical review committee (EA1/009/16). All patients included were above 18 years of age and no exclusions were made based on gender or primary malignancy. A surgical procedure was recommended for all patients after individual case presentation and discussion at our interdisciplinary peritoneal surface malignancy conference. Routine preoperative examinations such as CT scans, tumor markers (CEA, CA 19-9, and CA 125), and physical examinations were performed.

Procedure

Distress Thermometer

To measure distress, we used the Distress Thermometer (DT). It is a brief screening tool for cancer patients and consists of an 11-point numerical scale with scale endpoints being "no distress" and "extreme distress" and a problem list (PL). PL includes 37 items which are separated into the categories practical, family, emotional, physical problems and spiritual/religious concerns, and which should be answered with "yes" or "no." DT has been proven to be highly sensitive when evaluated against established criteria. For the German version, a cut-off score of 5 has been recommended [20]. According to this guideline, a score <5 results in the definition of low distress, while a score ≥5 means high distress and therefore indicates the need for psycho-oncological support.

Surgical procedure

To assess the extent of peritoneal involvement the PCI was estimated. Definitive evaluation of the PCI took place after explorative laparotomy and just before beginning of the cytoreduction. The procedure could include the following procedures in order to remove all visible peritoneal metastasis: exploratory laparotomy; abdominal wall resection including diaphragmatic, parietal, and pelvic peritonectomy as well as omentectomy; abdominal and pelvic lymphadenectomy; appendectomy; cholecystectomy; bilateral adnexectomy with hysterectomy; enterolysis; and ureterolysis. Organs were resected when they were affected by primary cancer or could not be cleared of peritoneal carcinomatosis. Extensive small bowel resection and/or ostomy formation were avoided whenever possible to preserve quality of life. Complete cytoreduction (CC) stated the absence of visible tumor nodules of more than 2.5 mm in size (CC = 0/1). Subsequently, HIPEC was performed at 42 °C for 60 min through a closed circulation system. Depending on the primary tu-

mor entity, different HIPEC protocols were delivered using unidirectional and/or bidirectional application of chemotherapy. The most commonly used intraperitoneal agents were combinations of cisplatin (75 mg/m²) and oxaliplatin (300 mg/m²) with mitomycin C (15 mg/m²) or doxorubicin (15 mg/m²). Bidirectional application of chemotherapy (5-Fluorouracil 400 mg/m² and folinic acid 20 mg/m² intravenously) was used for colorectal cancer patients.

Measures

Screening for distress has been carried out preoperatively in our outpatient clinic since 9/2013. Patients marked the scale of distress and associated problems on the DT questionnaire. Patients who were not able to fill out the questionnaire by themselves were offered assistance. The preoperative questionnaire was basically used to distinguish between patients with a high risk for postoperative distress (score ≥5, HDT) and those with a low risk for postoperative distress (score <5, LDT).

Patients in the high-risk group were automatically visited on one of the postoperative days 3–5 unless they declined consultation. LDT patients were visited either if they expressed a wish for psycho-oncological consultation or if the surgeon requested the consultation.

Depending on the frequency and necessity of psycho-oncological support, we distinguished between patients who had only one postoperative visit from a professional psycho-oncologist and no further assistance, patients with more than one consultation with a psycho-oncologist and regular support during hospitalization, and those who required continuous psycho-oncological treatment after surgery in the form of an outpatient consultation. Psycho-oncological treatment was defined as repeated psycho-oncological consultations.

Data concerning postoperative complications were collected in case medical, surgical, or intensive care therapy was necessary. In addition, postoperative complications were observed and a distinction was made between surgical (anastomotic leakage, intraabdominal abscess, fistula, etc.) and medical complications (cardiac, pulmonary, renal, etc.). Complications were assessed up to postoperative day 30 or until the patient was discharged if the hospital stay was longer than 30 days.

All patients were followed up after surgery and thereafter in an outpatient setting. The median follow-up was 7.7 (range 0.1–49.0) months. In total, two patients were lost to follow-up.

Statistical analyses

All statistical analyses were performed using either SPSS 23.0 (International Business Machines Corporation, Armonk, NY, USA) or Prism 6.0 (Graphpad Software, Inc., La Jolla, CA, USA). Continuous descriptive data are given as mean and range. Categorical data are given as frequencies and proportions. Groups were compared according to the following parameters: age, sex, PCI score, primary malignancy, distress score, and postoperative complications. We compared LDT and HDT patients with respect to categorical variables using the Fisher exact test or the Pearson χ^2 test, while comparisons with respect to quantitative variables were performed using the Wilcoxon rank sum test. We considered results to be significant at $p < 0.05$. Logistic regression analysis of the problem list was performed using the backward conditional method to test for intervariable relations. Factors that yielded a $p < 0.10$ in univariate analysis were assessed in the logistic regression model using the forward method.

Results

Participant characteristics

In total, 213 patients, 122 (57.3%) female, with a median age of 55.9 years (range 19–79) were included in this study. The mean PCI was 15.5 (range 0–39) and CC was achieved in 146 (69.9%) patients. The 30-day postoperative mortality rate was 2.6% (6/231 patients). In total, in four patients the CC score was missing in the patient chart.

Table 1 Patients' demographics

Descriptive	
Patient	
Female [%]	57.3 (122/213)
Age [years]	55.9 ± 12.1
PCI	15.5 ± 11.9
Primary malignancy [%]	
LAMN	16.0 (34/213)
Gastric	23.5 (50/213)
Colorectal	23.0 (49/213)
Ovarian	8.0 (17/213)
Mesothelioma	11.3 (24/213)
Appendiceal	7.5 (16/213)
Cancer of unknown primary	3.3 (7/213)
Small bowel	2.3 (5/213)
Others	3.3 (7/213)
Primary peritoneal carcinoma	1.9 (4/213)
Complete cytoreduction [%]	69.9 (146/209)
30-day postoperative mortality [%]	2.8 (6/213)
Preoperative PO screening [%]	49.3 (105/213)
Postoperative PO visit	43.2 (92/213)
Postoperative PO treatment	23.5 (50/213)
Continuous PO treatment	17.4 (37/213)
Psycho-oncological distress score	5.4 ± 2.7
Psycho-oncological distress score ≥5	70.2 (73/104)
PCI Peritoneal Cancer Index, *LAMN* Low grade appendiceal mucinous neoplasm, *PO* Psycho-oncological	
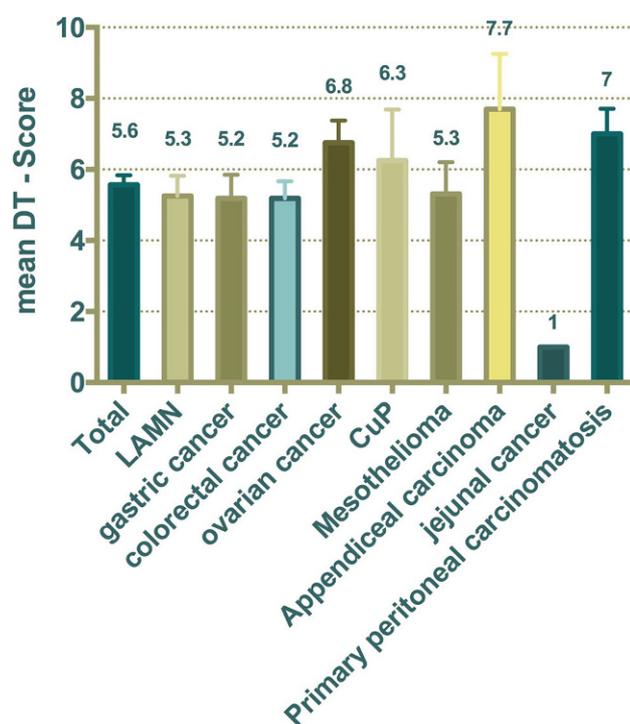
Fig. 1 Mean DT score related to underlying disease. *DT-Score* Distress Thermometer-Score

Table 2 Postoperative complications in patients after CRS and HIPEC

Descriptive	
Patient	
Postoperative mortality [%]	3.8 (8/213)
Postoperative complications [%][a]	41.3 (88/213)
Surgical complications [%][a]	21.6 (46/213)
Anastomotic leakage	2.3 (5/213)
Intraabdominal abscess	5.6 (12/213)
Fistula	2.8 (6/213)
Fascial dehiscence	4.2 (9/213)
Wound complication	12.7 (27/213)
Bleeding	5.2 (11/213)
Others	0.5 (1/213)
Medical complications [%][a]	32.4 (69/213)
Cardiac	5.6 (12/213)
Pulmonal	23.0 (49/213)
Renal	8.0 (17/213)
Hepatocellular	1.9 (4/213)
Sepsis	8.5 (18/213)
Thrombosis	2.8 (6/213)
Pancreatitis	3.3 (7/213)
Symptomatic transitory psychotic syndrome	6.1 (13/213)
[a]Multiple parameters per patient possible	

Overall, 105 (49.3%) patients participated in the preoperative psycho-oncological screening with a mean DT score of 5.4 (SD 2.7) and a median DT score of 6.0 (0–10). One patient did not mark a DT score, but completed the PL. In total, 86 of 105 (81.9%) participating patients filled out the PL. The reasons for incomplete data are unknown.

The number of HDT patients was 73 (70.2%). The mean DT score in female patients was 6.2 (SD 2.6) compared to 4.8 (SD 3.4) in male patients ($p = 0.022$).

92 patients were postoperatively visited by a professional psycho-oncologist, 50 of them were treated in consecutive consultations. The outpatient psycho-oncological support was used by 37 patients. Regarding the subgroup analysis, 46 of 73 patients (63%) were postoperatively visited by a professional psycho-oncologist in the HDT group compared to 15 of 31 (48.4%) in the LDT group ($p = 0.12$). In total, 28 and 20 patients (38.4%, 27.4%) in the HDT group were treated in consecutive or outpatient consultations, compared to 7 and 3 patients (22.6%, 9.7%; $p = 0.09$; $p = 0.04$) in the LDT group, respectively. Patient demographics are illustrated in Table 1. DT score regarding the underlying disease is shown in Fig. 1.

The overall postoperative complication rate was 41.3%, including 21.6% surgical complications and 32.4% medical complications. The postoperative mortality was 3.8%. Further details of postoperative complications of patients after CRS and HIPEC are shown in Table 2.

Comparison of patients with high ≥5 and low <5 distress scores

The proportion of patients feeling distress (score ≥5) was 70.2% (73/104). Analyzing several patient and disease parameters which potentially influence the DT score ≥5, only female gender reached a level of significance ($p = 0.02$). Factors like intraabdominal tumor mass (PCI; 15.5 vs. 15.9; $p = 0.90$), underlying disease ($p = 0.51$), patient age (54.7 vs. 58.4 years; $p = 0.15$), or CC (76.4 vs. 67.7%; $p = 0.25$) did not significantly influence the DT score of the patients. Patients with appendiceal carcinoma or primary peritoneal carcinomatosis showed the highest psychological distress score (7.7 ± 4.9 and 7.0 ± 1.4). Patient demographics and a comparison of the HDT with the LDT group are shown in Tables 3 and 4.

Postoperative complication rates did not differ between HDT patients and LDT patients ($p = 0.47$).

Patients of the HDT group were more likely to be in need of postoperative psycho-oncological treatment (28/73) and ongoing psycho-oncological consultations after discharge (20/73) compared to the LDT group (7/31; 3/31; $p = 0.09$ and $p = 0.04$, respectively).

Table 3 Patient demographics and parameters comparing patients with high psychological distress (score ≥5) and patients with low risk

	Screening score <5		Screening score ≥5		p-value
	n	%	n	%	
Patients	31	29.8	73	70.2	–
Female	11	35.5	47	64.4	0.006*
Age means[years] (SD)	58.4 (10.3)		54.7 (12.5)		0.146
PCI (SD)	15.9 (13.2)		15.5 (12.3)		0.899
Underlying disease					0.51
LAMN	7	22.6	13	17.8	
Gastric cancer	7	22.6	15	20.5	
Colorectal cancer	10	32.3	17	23.3	
Ovarian cancer	0	0	4	5.5	
CuP	1	3.2	3	4.1	
Mesothelioma	3	9.7	10	13.7	
Appendiceal neoplasm	2	6.5	7	9.6	
Jejunal cancer	1	3.2	0	0	
Primary peritoneal carcinoma	0	0	4	5.5	
Complications[a]	14	45.2	31	42.5	0.483
Surgical complications[a]	9	29.0	19	26.0	0.464
Anastomotic leakage	3	9.7	2	2.7	0.155
Intraabdominal abscess	2	6.5	5	6.8	0.654
Fistula	2	6.5	2	2.7	0.344
Fascia dehiscence	5	16.1	3	4.1	0.049
Wound dehiscence	5	16.1	10	13.7	0.481
Bleeding	3	9.7	3	4.1	0.247
Ileus	0	0	1	1.4	0.702
Others	0	0	1	1.4	0.702
Medical complications[a]	11	35.5	20	27.4	0.275
Cardiac	2	6.5	5	6.8	0.654
Pulmonary	6	19.4	14	19.2	0.590
Renal	3	9.7	5	6.8	0.444
Hepatic	1	3.2	2	2.7	0.658
Sepsis	4	12.9	8	11.0	0.506
Thrombosis	0	0	1	1.4	0.702
Pancreatitis	4	12.9	1	1.4	0.027
Neurologic	5	16.1	4	5.5	0.087
Complete cytoreduction	21	67.7	55	76.4	0.249
Death during observation	8	25.8	11	15.1	0.154

[a]Multiple complications possible per patient
*Statistically significant p-value

Problem list items influencing distress score in patients treated with CRS & HIPEC

The most common problems for patients with peritoneal surface malignancies are fears, worry, and sadness. Univariate analysis showed significantly higher rates of problems associated with fears, nervousness, sadness, getting around, indigestion, and sleep in the HDT group compared to the LDT group. Problems including sadness (OR 2.69; $p=0.009$), getting around (OR 2.65; $p=0.01$), and sleep (OR 3.01; $p=0.004$) had a major influence on the psycho-oncological distress score in multivariate analysis. The PL and regression analysis are illustrated in Table 5.

Discussion

To the best of our knowledge, this is the first study evaluating psycho-oncological distress in patients with peritoneal surface malignancies treated with CRS and HIPEC. Furthermore, we are able to identify items from the PL, like sadness, getting around, and sleep, which have a significant influence on the psycho-oncological distress score. We aimed to correlate

Table 4 Mean distress score (± standard deviation) depending on patient factors

Patient factor	Distress score	p-value
Gender		0.022*
Female	6.19 ± 2.6	
Male	4.83 ± 3.4	
Underlying disease		0.268
LAMN	5.3 ± 2.5	
Gastric cancer	5.2 ± 3.1	
Colorectal cancer	5.2 ± 2.5	
Ovarian cancer	6.8 ± 1.3	
CuP	6.3 ± 2.9	
Mesothelioma	5.3 ± 3.3	
Appendiceal carcinoma	7.7 ± 4.9	
Jejunal cancer	1	
Primary peritoneal Carcinomatosis	7.0 ± 1.4	

CuP Cancer of unknown primary
*Statistically significant *p*-value

the DT score in this pilot study first with the clinical and prognostic status and secondly with postoperative complications of the patients.

The mean distress score in all patients was 5.4, whereby 73 of 104 patients (70.2%) reported high distress (DT score ≥5). These results are relatively high compared to those for several other types of cancer patients, reflecting the psychological condition in patients with end-stage oncological disease. In a large study on the distress of oncological patients, Chiou et al. showed an incidence of high distress of 48% in patients with head and neck, 11.2% with colorectal, and 3.9% with urological tumors, and 5.6% with leukemia [21]. Another large Irish study including 1419 patients with cancer identified female gender and young age as predictive factors associated with high DT score, while cancer type was not a significant factor. The median distress scores for the five largest groups (breast, hematological, lung and thoracic, gastrointestinal, genital) were 7.0 (1–10), 6.0 (0–10), 6.0 (0–10), 6.0 (0–10), and 6.0 (1–10), respectively [22]. These results are similar to our cohort, which showed a median distress score of 6.0 (0–10). Interestingly, the distress score is not related to life expectancy, since negative predictors for survival such as high PCI, impossibility for CC, and underlying disease did not show any correlation in this study.

Women in our study reported more distress than men. Large studies have identified that being of female gender, amongst other factors, was predictive of greater emotional distress [23–25].

It is well known that patients who scored high on a distress level made more use of psycho-oncological treatment than patients with a low distress score [26]. Notwithstanding, half the patients in our LDT group also had psycho-oncology needs. These results are in the line with other studies [25]. We were able to demonstrate that patients in our HDT group were significantly more often in need of ongoing outpatient psycho-oncological consultations compared to patients in our LDT group.

Cut-off levels for intervention

To be a clinically useful screening tool, the DT must have a clearly defined threshold for identifying patients who require further attention (e.g., further assessment and/or intervention). There are several studies identifying the cut-off score of at least four out of 10 as being the most widely utilized for categorizing "clinical" levels of distress. This cut-off is reported to have better negative predictive validity (77–97%) depending on criterion measure than positive predictive validity (38–71%) [27], making it better suited for ruling out rather than for identifying clinically significant distress [28]. DT score cut-offs up to seven have been proposed for identifying clinically distressed patients, and the debate over the most appropriate cut-off is still ongoing [27, 29]. According to the recommendation for Germany, the cut-off level for intervention in this study was chosen to be five [20].

Benefit from psychological intervention

There are several different intervention types, like individual psycho oncological counselling, group psychotherapy, couple counselling, relaxation training, and psychoeducation to improve psychological distress in patients. Whilst patients of our study were treated with individual psycho-oncological counselling with elements of psychoeducation and sometimes relaxation techniques, Faller et al. demonstrated in a recent systematic review and meta-analysis that these therapeutic options had small-to-medium effects on emotional distress, anxiety, depression, and health-related quality of life [30]. In general, a longer duration of treatment is associated with larger effects in emotional distress, depression, and anxiety, but only beyond a 6-month follow-up interval.

The large heterogeneity in published studies about psychological interventions varies regarding treatment form (inpatient, outpatient or web-based interventions), and cancer diagnosis (patients with breast cancer or hematologic diseases). There are no data about patients with peritoneal surface malignances regarding this topic. A randomized controlled trial focusing on the short-term impact of psycho-oncological interventions in breast cancer patients showed the significant reduction of anxiety and depression using the Hospital Anxiety and Depression Scale (HADS) during hospital stay. Interestingly, there was no significant difference between the groups at the 12 months follow-up [31, 32]. The patients with the largest benefit were those with high psycho-oncological distress.

Table 5 Univariate and linear regression analysis evaluating single aspects influencing distress score

Problem list	PO score <5		PO score ≥5		Univariate	Multivariate	
	n	%	*n*	%	*p*-value	OR (95% CI)	*p*-value
	28/86	32.6	58/86	67.4			
Practical problems							
Housing	0/86	0	4/86	6.9	0.20	–	–
Insurance/financial	1/85	3.6	3/85	5.3	0.60	–	–
Transportation	1/86	3.6	7/86	12.1	0.20	–	–
Work/school	3/86	10.7	5/86	8.6	0.52	–	–
Treatment decisions	5/86	17.9	14/86	24.1	0.36	–	–
Family problems							
Dealing with children	0	0	5/86	8.6	0.13	–	–
Dealing with partner	0	0	5/86	8.5	0.13	–	–
Ability to have children	1/86	3.6	1/86	1.7	0.55	–	–
Family health issues	1/84	3.6	10/84	17.9	0.06	0.61 (–0.19–0.36)	0.55
Emotional problems							
Depression	2/85	7.4	8/85	13.8	0.32	–	–
Fears	11/86	39.3	39/86	67.2	0.01*	1.04 (–0.10–0.32)	0.30
Nervousness	4/84	14.3	26/84	46.4	<0.01*	0.76 (–0.14–0.32)	0.45
Sadness	4/86	14.3	32/86	55.2	<0.01*	2.69 (0.07–0.46)	0.009*
Worry	13/84	46.4	37/84	66.1	0.07	–0.64 (–0.30–0.16)	0.53
Loss of interest in usual activities	2/86	7.1	11/86	19.0	0.13	–	–
Spiritual/religious concerns	0/86	0	0/86	0	n.a.	–	–
Physical problems							
Appearance	2/86	7.1	7/96	12.1	0.39	–	–
Bathing/dressing	0/86	0	4/86	6.9	0.20	–	–
Breathing	4/86	14.3	8/86	13.8	0.60	–	–
Changes in urination	1/85	3.6	6/85	10.5	0.26	–	–
Constipation	2/86	7.1	11/86	19.0	0.13	–	–
Diarrhea	5/86	17.9	12/86	20.7	0.50	–	–
Eating	5/85	17.9	19/85	33.3	0.11	–	–
Fatigue	10/82	37.0	32/82	58.2	0.06	–0.42 (–0.26–0.17)	0.68
Feeling swollen	2/85	7.4	14/85	24.1	0.06	1.44 (–0.07–0.42)	0.16
Fevers	0/86	0	2/86	3.4	0.45	–	–
Getting around	1/86	3.6	16/86	27.6	<0.01*	2.65 (0.08–0.53)	0.01*
Indigestion	2/86	7.1	15/86	25.9	0.03*	0.39 (–0.20–0.30)	0.70
Memory/concentration	3/86	10.7	8/86	13.8	0.49	–	–
Mouth sores	2/86	7.1	5/86	8.6	0.59	–	–
Nausea	4/86	14.3	14/86	24.1	0.22	–	–
Nose dry/congested	3/86	10.7	7/86	12.1	0.58	–	–
Pain	5/86	17.9	16/86	27.6	0.24	–	–
Sexual	1/86	3.6	4/86	6.9	0.47	–	–
Skin dry/itchy	3/85	10.7	7/85	12.3	0.57	–	–
Sleep	1/83	3.7	24/83	42.9	<0.01*	3.01 (0.11–0.53)	0.004*
Tingling in hands/feet	7/84	25.9	16/84	28.1	0.53	–	–
*Statistically significant *p*-value							

Several studies reported about unselected intervention for patients with cancer; however, treatment is much more effective for patients screened for high distress at entry. The effect sizes for screened versus not screened patients of 2.7:1 for depression and 2.1:1 for anxiety published in a systematic review by Linden and Girgis in 2012 [33] emphasize the importance of screening tools like the DT.

Further studies, though with a small sample size, only revealed psychoeducational intervention, couple intervention including the patient's partner, and physical activity as effective interventions to improve

symptoms like depression, anxiety, and quality of life during treatment [34–36].

The most important predictors for long-term psycho-oncological distress are baseline distress and neuroticism according to a recently published systematic review by Cook et al. in a palliative care setting. This study from the US has to be interpreted carefully, as the results might not be applicable to our European standard of care. Interestingly, there was no rational evidence that demographic, clinical, or social factors reliably predict longer-term distress [37]. The main outcome scores to measure the effectiveness of psychological interventions are mutual (health-related) quality of life, patient's symptoms like depression, anxiety, and distress itself.

More importantly, successful early psychosocial interventions have shown potential to influence disease course beyond psychosocial outcomes [38]. Differences in efficacy between different therapy types such as education, relaxation, cognitive behavioral therapies, and expressive support were not demonstrated in a large meta-analysis by Heron-Speirs et al. in 2013 [39].

Whereas the attractiveness of the internet with its beneficial appointment-independent availability is growing, a recently published randomized controlled intervention study indicated that web-based guided self-help has potency to accurately support newly diagnosed (≤12 weeks) patients with cancer [40]. In addition, all participants spent a median of 165 min with a psychologist.

Psycho-oncological consultation

The participant rate of 49.3% is low compared to other studies (above 80%) which also used the DT. Therefore, a potential selection bias must be addressed [41]. It is likely that this effect reflects an underestimation of the preoperative distress. Patients declining to participate are often the most emotionally traumatized and lack sufficient resources to cooperate. We found a difference in the rate of continuous postoperative psycho-oncological treatment between patients who preoperatively completed the DT and patients who did not (33.3 vs. 13.9%; $p = 0.001$). The fact that patients received significantly more psycho-oncological consultations in the screening group is due to the nature of the preoperative screening, which triggered postoperative consultation as part of our clinical routine.

A ratio of 27.4% of patients in the HDT group treated with consecutive psycho-oncological consultations >3 months seems rather low and indicates a potential aspect to improve postoperative patient care.

We were unable to demonstrate any correlation between preoperative distress and the postoperative outcome. Patients with distress did not develop more or less postoperative complications, neither surgical nor medical. The hypothesis that patients with lower preoperative distress experience less complications during a hospital stay could not be confirmed. Interestingly, Mejdahl et al. could demonstrate that preoperative distress predicts persistent pain after breast cancer treatment [42]. Any other correlation with the postoperative complication rate has not been published to date.

PL and relevant factors

Correlating the different items of the questionnaire with the DT score, we could identify three items which significantly influenced a high distress score (≥5) in patients with peritoneal surface malignancies. These items were problems with sadness, getting around, and sleep. Little is known about the impact of specific items of the questionnaire. Most data available about interventions demonstrated that many interventions, like relaxation training and psychological support, had an impact on depression and anxiety, as published in a recent meta-analysis which considered nearly 20,000 Chinese cancer patients [43]. Intercultural differences for the specific items are estimated to be rather high.

This pilot study involved just one hospital and although our department provides medical care to a large area of Germany due to its status as a center of excellence in the treatment of peritoneal surface malignancies, this fact might limit the generalization of the study's results. Unfortunately, there are no data about the distress score in non-cancer patients in central Europe, which makes a comparison difficult and prohibits a strong recommendation for psycho-oncologic intervention due to the lack of a control group, meaning the general population.

Another limitation might be seen in the postoperative correlation of our results. There is no postoperative distress score which could show us whether the psycho-oncological intervention was successful or not. In addition, a quality of life questionnaire has not been used so far, which might be of further interest for future clinical studies.

This study demonstrated that psychological distress in patients with peritoneal surface malignancies is high. In total, 70.2% of the patients had a DT score of ≥5. The hypothesis that patients with lower preoperative distress experience less complications during a hospital stay could not be confirmed.

Preoperative screening might be useful to monitor the impact of interventions and for identification of patients with high and very high psycho-oncological distress. Further studies are needed to evaluate screening and effectiveness of early psycho-oncologic interventions in these patients.

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